WHAT IS CLAIMED IS:

1. A process for producing a methacrylate-based polymer, comprising:

polymerizing (d1) a radical-polymerizable monomer containing at least one methacrylate-based monomer in the presence of (c1) a redox catalyst comprising a metal complex containing at least one transition metal as a central metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, said redox catalyst containing a low-valence metal $(M)^n$ wherein n represents an atomic valence of the metal, and a high-valence metal $(M)^{n+1}$ both constituting the redox catalyst system, and having a molar ratio of $(M)^n$ to $(M)^{n+1}$ of 90/10 to 0.1/99.9, upon initiation of the polymerization, using (a1) at least one polymerization solvent selected from the group consisting of water, ethers, amides, nitriles and alcohols, and (b1) a polymerization initiator selected from the group consisting of organohalogen compounds, halogenated sulfonyl compounds and halogen-containing macroinitiators.

2. A process according to claim 1, wherein the polymerization solvent is at least one solvent selected from the group consisting of water, ethers, amides and alcohols.

3. A process according to claim 1 or claim 2, wherein the low-valence metal $(M)^n$ is at least one metal selected from the group consisting of Cu^{1+}, Ru^{2+}, Fe^{2+} and Ni^{2+}.

4. A process according to claim 1, wherein the polymerization initiator is an organohalogen compound or a halogenated sulfonyl compound.

5. A polymer produced by the process as defined in claim 1.

6. A polymer according to claim 5, having a molecular weight distribution of Mw to Mn of not more than 1.8.

7. A process for producing a block copolymer, comprising at least the following step (i) and step (ii):

(i) forming a first block chain, said step (i) comprising polymerizing (d2) an acrylate-based monomer in the presence of (c2) a redox catalyst comprising a metal complex containing at least one transition metal (M) as a central metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, and a ligand containing at least a halogen atom selected from the group consisting of bromine and iodine, using (b2) a polymerization initiator selected from the group consisting of bromine- or iodine-containing organic halides and bromine- or iodine-containing halogenated sulfonyl compounds; and

(ii) forming a second block chain, said step (ii) comprising polymerizing (d3) a methacrylate-based monomer in the presence of (c3) a redox catalyst comprising a metal complex containing at least one transition metal as a central

metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, and a ligand containing at least a halogen atom selected from the group consisting of chlorine and fluorine, said redox catalyst containing a low-valence metal $(M)^n$ wherein n represents an atomic valence of the metal, and a high-valence metal $(M)^{n+1}$ both constituting the redox catalyst system, and having a molar ratio of $(M)^n$ to $(M)^{n+1}$ of 90/10 to 0.1/99.9, upon initiation of the polymerization for forming the second block chain.

8. A process according to claim 7, wherein the low-valence metal $(M)^n$ is at least one metal selected from the group consisting of Cu^{1+}, Ru^{2+}, Fe^{2+} and Ni^{2+}.

9. A block copolymer produced by the process as defined in claim 7.

10. A block copolymer comprising an acrylate-based block chain and a methacrylate-based block chain, at least one propagated end of the methacrylate-based block chain being a halogen end.

11. A block copolymer according to claim 10, wherein an amount of the halogen end is 0.7 to 1 per one propagated end.

12. A block copolymer according to claim 10, wherein the halogen end is a chlorine end or a fluorine end.

13. A block copolymer comprising an acrylate-based block chain and a methacrylate-based block chain which is produced by a process comprising the following step (i) and step (ii):

(i) forming a first block chain, said step (i) comprising polymerizing (d2) an acrylate-based monomer in the presence of (c2) a redox catalyst comprising a metal complex containing at least one transition metal (M) as a central metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, and a ligand containing at least a halogen atom selected from the group consisting of bromine and iodine, using (b2) a polymerization initiator selected from the group consisting of bromine- or iodine-containing organic halides and bromine- or iodine-containing halogenated sulfonyl compounds; and

(ii) forming a second block chain, said step (ii) comprising polymerizing (d3) a methacrylate-based monomer in the presence of (c3) a redox catalyst comprising a metal complex containing at least one transition metal as a central metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, and a ligand containing at least a halogen atom selected from the group consisting of chlorine and fluorine, said redox catalyst containing a low-valence metal $(M)^n$ wherein n represents an atomic valence of the metal, and a high-valence metal $(M)^{n+1}$ both constituting the redox catalyst system, and having a molar ratio of $(M)^n$ to $(M)^{n+1}$ of 90/10 to 0.1/99.9, upon initiation of the polymerization for forming the second block chain.

14. A process for producing a block copolymer, comprising:

first forming a first block chain by polymerizing (d4-1) an acrylate-based monomer in the presence of (c4) a redox catalyst comprising a metal complex containing at least one transition metal (M) as a central metal selected from the group consisting of elements of Groups 7 to 11 of the Periodic Table, using (b4) a polymerization initiator selected from the group consisting of organohalogen compounds and halogenated sulfonyl compounds; and

then forming a second block chain by polymerizing the first block chain with an acrylate-based monomer and/or a styrene-based monomer, and a methacrylate-based monomer.

15. A process according to claim 14, wherein the central metal (M) is at least one metal selected from the group consisting of Cu, Ru, Fe and Ni.

16. A process according to claim 14, wherein a ratio of the acrylate-based monomer, the styrene-based monomer to the methacrylate-based monomer or mixture thereof is 1 to 50% by weight.